THE MATHEMATICS TEACHER

EDITED BY
W. H. METZLER

ASSOCIATED WITH

EUGENE R. SMITH HARRY D. GAYLORD
GEO. GAILEY CHAMBERS WILLIAM E. BRECKENRIDGE

VOLUME XII SEPTEMBER, 1919 NUMBER 1

AN EXPERIMENT IN MOTIVATION.

By WILLIAM S. SCHLAUCH.

Educators are generally agreed that the genesis of knowledge in the individual should follow the line of evolution by which the race conquered and learned to interpret its environment. When challenged by a new situation man bent his energies to the solution of the problem that perplexed him. His environment presented a series of problems to him and out of the series of efforts to feed, clothe, and shelter himself, and harness the forces of Nature the sciences gradually differentiated out of a mass of common knowledge. Mathematical relations were investigated first because they were involved in solving some definite problem in which the investigators were interested.

The usual procedure in our high schools, and even in the elementary schools, is to present differentiated and organized sciences to our students, prescribing algebra, geometry, and trigonometry as "requirements for graduation," taking little thought of whether or not the student is interested in acquiring a working knowledge of quadratic equations, series, sines, cosines and tangents. The trite observation that students learn a subject much faster if they are interested in it than if it is presented to them as a task to be learned "willy-nilly," has so far born little fruit in the shape of presenting mathematics or sciences as a way of exploring the world or solving problems in which the student is really and immediately interested.

During the summer session of 1918 at New York University

the author had a number of interesting discussions with Prof. James E. Lough, director of the summer school, and dean of the extra-mural division of the university, about methods of presenting mathematics to students in such fashion that it would be a tool for investigating and solving problems in which the student's interest is already aroused. As professor of psychology he was eager to try the experiment of presenting trigonometry and even algebra as collateral and necessary tools of investigation in the fields of artillery practice and navigation. We agreed to offer two courses in the extra-mural division, beginning late in September, 1918. One called "The Mathematics of Navigation," and the other "The Mathematics of Gunnery." No college credit was to be allowed for either course. They were opened to students who had an elementary knowledge of algebra. The dean generously allowed students of the High School of Commerce to enter the courses free of charge. They were given in the afternoon, from 3:30 to 5:30 P.M., each once a week. Only students who expected to be drafted and looked forward to entering the artillery or naval arms of the service were appealed to. Little effort to advertise the courses outside the High School of Commerce was made, and the courses were made up almost exclusively of Commerce boys in the senior and junior classes. We expected a half dozen students for each course. Twenty registered for the course in artillery, and nineteen for the course in navigation.

Bear in mind that all these students with three exceptions had a full day's program of study and recitation as students in the High School of Commerce; that they were willing to put in two hours a week in addition to their regular school work, studying a subject for which they would receive neither credit toward graduation, nor credit at the university. They wanted the knowledge offered in the courses to help them in solving a real problem—that of advancing more rapidly in the service if called by the government to serve in the war. The motive was real and compelling. Day after day these young men met and learned as much trigonometry in one lesson as is covered by the ordinary student in a week or more. No teacher ever had more absorbed attention, or more determined spirit on the part of his students.

And note that the students were not told that they were being taught physics, algebra and trigonometry as collaterals of the courses. They were studying navigation and gunnery calculations, and that was the center and focus of attention, and they were interested in those subjects because they expected to enter those fields. They visualized a situation as impending that would bring these fields into their lives, and the response in interest was remarkable. Up to the time the armistice was signed the classes remained full. About half dropped out the week after the armistice was signed. Those who remained had become so much interested in the subject matter itself that they remained because of the pleasure they derived "from successful functioning."

The method of introducing the mathematics as a tool for investigating the problems of artillery or navigation may be best understood from specific examples. After presenting some information about the three-inch field piece, explosives, internal pressure and rifling, the student studied the path of a trajectory in vacuo, drawing or plotting to scale on cross section paper the path of the trajectory having a given initial velocity, the angle of elevation being also given. The path was plotted by combining the factors

$$S = vt$$

and

$$S' = \tfrac{1}{2}gt^2.$$

The position of the trajectory for $t = 1, 2, 3, \ldots$ was plotted and the curve thus located. Then the range table for the trajectory in air given in War Department Document No. 391 was taken up. The student was made familiar with the concepts of range, angle of departure, quadrant angle of departure, the jump, drift, angle of fall, etc. The experimental methods involved in making the table were described. The whole situation in the field, with wind, air pressure, and other modifying circumstances was made a reality for the students. The columns of the table then had a meaning for the students. But the impossibility of always having a range table at hand occurred to a number of students, who introduced the question "Can't you tell the range K, when you know ϕ in mils without a table?"

The lecturer followed this lead and presented the solution of the problem raised in what would have been called in a formal lecture course "Rapid Calculation of the Elements of the Trajectory." And the solution of this problem, which involved the empirical equation

$$\phi \text{ (in mils)} = 5K(K + 3)$$

led to enough practice and comparison with the figures of the table, to familiarize the students with the equation, so that when the range K was given in thousands of yards, the angle of departure ϕ in mils was easily and rapidly found by the class. The discussion brought out the question: Suppose your angle of departure is set, can you tell by an easy calculation how far your shell will go? The students themselves by a leading question discovered that they would have to solve

$$\phi = 5K(K + 3)$$

for K. Now, practically all of the class had never had quadratic equations. They agreed that it would be much better to learn how to solve one equation for a second letter than to try to memorize two equations. So they were given a lesson on completing the square and solving quadratics, as well as a short drill on simplifying radicals. The resulting equation

$$K = -\frac{3}{2} + \sqrt{\frac{\phi}{5} + \frac{9}{4}}$$

or

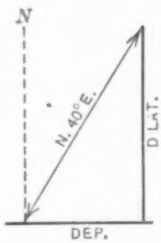
$$K = \sqrt{\frac{\phi + 11}{5}} - 1.5$$

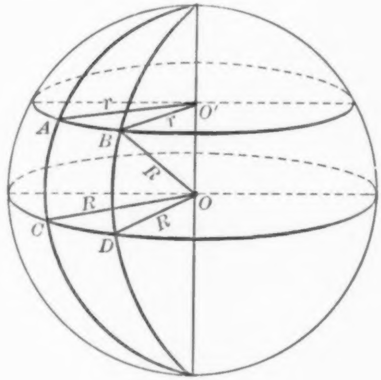
was more easily memorized because of the attention and thought processes involved in deriving it. Besides, they did not need to memorize it. They could derive it at any time. To those students, quadratic equations mean a tool for working out a problem in which they were interested.

Again, consider the mathematical avenues opened by a consideration of the problem of firing from behind a mask.

In the diagram, G is the gun, T the target, y is the mask, t is the actual trajectory and P is the Percin parabola, whose ordinates are always smaller than those of the actual trajectory of

the same range, R. The problem is to find x, the distance behind the mask whose height is y yards, that the gun must be placed so that the shell will clear the mask.





Percin's parabola has the equation

$$4y = x(R - x),$$

in which R = entire range from gun to target in *hundreds of yards*, y is the ordinate in yards corresponding to any abscissa x expressed in hundreds of yards. $R - x$ and y are known by range finder and measurements. Then

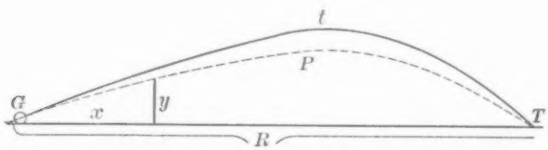
$$x = \frac{4y}{R - x}.$$

A review of literal equations grew out of this section.

This same problem of firing from behind a mask opened the subject of solution of triangles by use of trigonometric functions. The situation of the guns, the aiming point, the battery commander's station and the problems to be solved were vividly presented by diagram. The investigation led to the study of the relation of angles in a triangle, and the solution of a triangle by trigonometry.

In the diagram, T is the target and also represents the angle BTG at T. P is the aiming point, visible from all of the guns, G_1 to G_4, inclusive. The target T is visible from the Battery Commander's station B, but not from the guns which are placed

behind the mask M. The angle through which B turns his panoramic sights is read directly, and the distances BG, G_1G_2, G_2G_3, BP, etc., are known. If BT is found by using range finder or mils rule, the angle at T can be estimated in mils. Then the



azimuth through which G_1 must be revolved from direction G_1P is $\angle d + \angle a$. Call it G_1. Call the angle PBT, B. Then $B = x + y$. Since

$$x = a + T$$
$$y = d + P.$$
$$\therefore x + y = a + d + T + P$$

or

$$B = G_1 + T + P$$

and

$$G_1 = B - P - \mathrm{T}$$
$$= B + (-P - T).$$

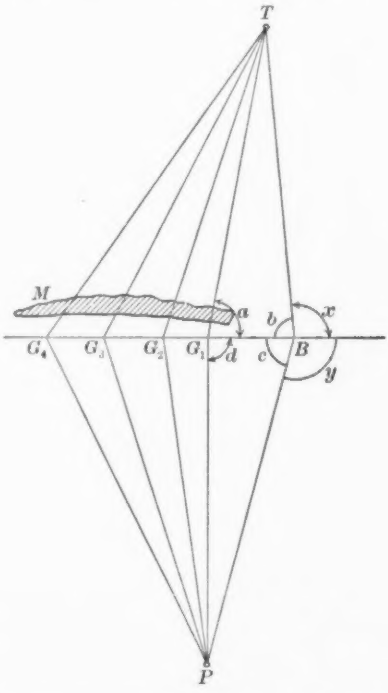
When aiming point is in front of line G_1B instead of in the rear, and to left or right of T, it is easily seen that

$$G_1 = B + (P - T).$$

Here we have a motive for studying the relations of angles in a triangle, exterior angle, etc. Further, when BG_1 is known and BT given by range finder, the class discussion very naturally led to the question "Can the range $G_{1,}T$ be calculated?" Right here the fact that sines of angles are involved was brought out, and a lesson was given in trigonometric functions. Tables of natural functions were mastered and triangles solved, using the law of sines before new gunnery problems were considered.

In the case of the navigation course, angles and angle relations were taught in connection with the compass; charts and chart reading involved teaching some rudimentary mathematical geography, and piloting brought up the solution of triangles. Thus: In locating the ship by the one point bearing method. Present

to the class by diagram the situation. Read the log when the ship is in such position (S) that the known object L is one point forward of (or abaft) the beam, and also when it is abeam at S'. The distance $S'L$ will be 5 times the distance run. Now the question is at once brought up, Why? Of course, it is be-



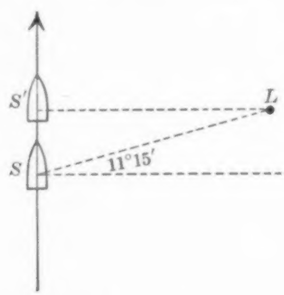
cause $S'L = SS'$ cot 11° 15′ and cot 11° 15′ is approximately 5 (5.0273). But right here in piloting a number of the methods called for the use of natural functions, and the eagerness with which the students took up and mastered them, the use of the tables, and the solution of the right triangle showed that this was the natural method of presentation. Trigonometry grew up or differentiated out of the investigation of space relations which were being studied because of a vital interest in them on the part of the students. Plane sailing and dead reckoning furnished practice for the knowledge of how to solve the right triangle trigonometrically.

To understand the use of the traverse table in Bowditch, the student needed to be able to interpret these figures, and understand that in Fig. 1

Distance $\times$ cos course angle $=$ D.Lat. or

$$\text{distance} = \frac{\text{D.Lat.}}{\text{cos course angle}}. \qquad (1)$$

In Fig. 2, AB is the departure of a ship, R is the radius of the earth, r the radius of the parallel of latitude over which the ship



sailed (AB). DOB is the latitude of the ship, COD is the D.Long. corresponding to the departure AB.

Now

$$AB : CD = r : R$$

$$= R\,(\sin 90 - \text{Lat.}) : R.$$

That is,

$$\text{Dep.} : \text{D.Lo.} = R \cos \text{Lat.} : R.$$

$$\therefore \text{D.Lo.} = \frac{\text{Dep.}}{\text{cos. Lat.}}. \qquad (2)$$

The similarity, or rather identity of form, of equations (1) and (2) explains why the same traverse table can be used in finding D.Lat. and Departure and D.Lo. It is easy to see that when the plane sailing and dead reckoning situations were presented to the student and he was shown that cosines and sines were involved, his previous experience with them in piloting would help, and give him a needed review.

Some Results.—Although half the students dropped out of the courses at the signing of the armistice, those who finished

the courses became interested in solid geometry and trigonometry and at the end of January, when new classes were organized, the class in trigonometry was three times as large as during the fall term. Ours is a commercial school, and solid geometry and trigonometry are only tolerated for those boys who "find themselves" as not adapted to commercial careers, and want to fit themselves for technical or other colleges. Those boys who took the courses in navigation or artillery and are now taking trigonometry are doing so because they see a need for mastery of trigonometry as a *science*, so that they may more thoroughly understand the *rationale* of a field in which they are interested. It is to them a means of interpreting life.

The ordinary teacher of mathematics may object that such methods of approach to high-school mathematics take too much time and require too much knowledge of applied fields on the part of the teacher. The answer is that if we would follow the line of natural evolution in the genesis of knowledge, life situations and problems in which the student is interested must arouse the desire for mathematics as an aid in solving these problems. It is the teacher's province to master the mathematics of these applications, to be able to present the subject matter of secondary-school mathematics through these problems. Commercial mathematics of an advanced type, and even simpler business calculations afford rich mines of material for such algebraic topics as literal equations, the binomial theorem, series and logarithms. How many high-school teachers know that the formula

$$A_0 = \frac{R}{i}\left\{1 - \frac{1}{(1+i)n}\right\}$$

by which the basis price of a bond may be calculated when basis rate, interest rate, time to run are given, is best derived by the formula for the *sum* in a geometric progression? Why should not an investment, installment payment, or bond problem be the avenue through which geometric progression is presented to the student? It can be done. We are doing it in the High School of Commerce.

HIGH SCHOOL OF COMMERCE,
NEW YORK CITY.

SCALES FOR THE STUDY OF CHILDREN'S CHARACTERISTICS.

By Eugene Randolph Smith.

Recent issues of The Mathematics Teacher have given considerable attention to standardized tests and their influence on the teaching of mathematics. The authors, Dr. Minnick and Dr. Rogers, while they are convinced of the value of such tests, recognize their limitations, up to this time, in that they test the more routine kinds of work. They, with other investigators, have been trying to develop tests that will gage the fundamental qualities that underlie successful accomplishment in the subjects in question.

A criticism of all standardized tests that has been quite widespread is that the finer qualities of mind and soul do not lend themselves to definite measurement, and so are likely to become undervalued and underemphasized, if teachers are primarily judged by the results of such tests.

There seems to be some justice in this contention, especially where insufficient supervision fails to guard against such dangers. On the other hand, the value of these tests has proved itself in many ways both in analyzing and helping to correct weaknesses, and in determining what is a fair expectation in the various subjects.

The solution seems to me to be directing the teachers' attention to child development and the importance of the moral and social characteristics, as well as those particularly affecting school work. If a combination of subjective and objective methods can give a school an all around knowledge of a pupil, and enable it to study his development from year to year, the ideal of an intelligent diagnosis of each pupil's needs will be in a fair way to be reached.

In The Park School, in addition to objective methods, subjective judgments of salient characteristics of pupils have been an important part of its records ever since the school opened. Experience has modified the forms and methods, and has shown

various weaknesses, but even in their least valuable forms the records proved their worth very conclusively.

The latest development worked out in this school consists in a card system that takes up the child from the following viewpoints: Intelligence, Physical, Social and Moral, School Work, Standardized Tests, General Information, Home Conditions, Supplementary Remarks, with a manual of scales by which to mark the characteristics under each head.*

It is expected that the system will help to accomplish the following aims:

To help the teacher to think in terms of children and their development rather than chiefly of lessons.

To bring to the surface those indications in each child that show some particular need (either shown by a single report, or brought out by reports through a number of years), and, in many cases, to suggest the best way to meet this need; the comparative study made possible by the reports of all a pupil's teachers is especially helpful in this.

To give the supervisor a better insight into the life of the school; such records not only give information about the pupils, but often prove the most valuable guides for correcting conditions and helping the teachers.

To serve as a basis for judgment as to the best course to be pursued by a pupil in school, and as a help in advising him when he leaves school; parents also can often be helped to wise decisions by making it possible for them to see such studies of their children.

To keep in condensed form a complete record of the pupil's school life, so that it will serve as a permanent source of information from which questions of prospective employers, or other justified inquiries can be helpfully answered.

To enable a college to ask for, and a school to give, a definite and helpful report on a candidate's qualifications.

The subheads under "Social and Moral" are Attitude or Public Spirit, Honesty, Sociability, Consideration, Self-Control and Poise, Initiative, and Leadership. Those under "School Work" are Interest, Industry, Concentration, Perseverance, Self-Reliance, Care and Neatness, and Progress.

* "Card System and Manual of Pupil Analysis," by Eugene R. Smith. Published by C. W. Bardeen, Syracuse, N. Y.

The teacher places a child in one of five defined groups in each characteristic, the fact of the group's being definitely outlined insuring something of a common language and a common understanding between teachers. For example, certain typical scales define these groups or classes as follows:

Industry.

Class 1. Those who try to get as much as possible from the course, showing enough interest and initiative to investigate beyond the teacher's requirement.

2. Those who conscientiously meet all requirements, both in giving attention and in doing assigned tasks.

3. Those who have the general intention of conscientiously applying themselves to their studies, but fail often enough in carrying out this intention to force the teacher to take too much responsibility for work the pupil should do.

4. Those who are decidedly irregular in their attention and application, so that the teacher must continually apply pressure.

5. Those who will not, or cannot, hold their attention to their work. This may be shown in class, in project work or study, or in all.

Leadership.

Note: Do not confuse popularity with leadership.

Class 1. Those who are leaders by free choice of their comrades and who succeed in that leadership without antagonizing others.

2. Those who lead by the domination—

(*a*) of personality.

(*b*) of mentality.

(*c*) of physical superiority.

(*d*) Those who are freely chosen as leaders, but whose carrying out of the leadership is only moderately well done.

3. (*a*) Those who show restricted qualities of leadership, shown only where they are particularly interested or expert, or in helping to work out group plans.

(*b*) Those who, while too individual to follow others, have not developed the ability to get others to follow them.

4. Those who coöperate somewhat in group projects, and show some intelligence in helping to choose the leaders.

5. Those who are undiscriminating followers.

The numerical mark should be followed by a + for those who show a positive influence for good, even though the one marked shows no high degree of leadership, and by a — for those whose influence is detrimental.

Perseverance.

Class 1. Those who are unwilling to give up a project that has been undertaken, even though the only reason for persevering is a desire to achieve.

2. Those who persist in any undertaking for which they have some definite motive besides the desire to achieve.

3. Those who are generally conscientious in completing a task undertaken but are likely to be discouraged by difficulties.

4. Those who will not continue a struggle unless they think they see success almost within reach.

5. Those who are unable or unwilling to force themselves to attack difficulties.

Consideration.

Class 1. Those who are thoughtful of others, even at the expense of their own interests, and express this thoughtfulness in the formalities of courtesy.

2. Those who are careful of others' rights, and courteous in their observance of them.

3. Those who, while courteous in intent, and with a sense of fairness, thoughtlessly violate the observance of courtesy.

4. Those who are heedless of others' rights.

5. Those who selfishly violate others' rights and show no desire to be courteous.

Perhaps the most interesting scale is that for intelligence. Subjective scales for this marking have suffered in the past from failing to analyze the child's mind as it showed in school work because of their association of uncorrelated mental characteristics, and from an attempt to make too many exclusive classes, thus confusing the teacher by fine distinctions.

As intelligence is very difficult to judge, and the variations in detail are very great, a four place numerical system of marking has been devised. This requires the teacher to judge each of four characteristics of the child's mind as it shows in her work

rather than to give a single mark for intelligence. While this does not ask for very fine distinctions under each head, the result is a rather definite intelligence classification.

A. Initiative and Originality.

Class 1. Those generally able to start and carry on projects or investigations without suggestion from others.

2. Those generally able to carry on alone projects or investigations started or outlined by others.

3. Those who can help in group projects or investigations. They may show a higher degree of initiative or originality where they have particular interest or expertness. (For example, a boy whose father is an electrician may appear to have more originality in this line because his environment has helped him to acquire greater skill and knowledge of it.)

4. Those who show little originality themselves, but appreciate the initiative and originality in others enough to follow their lead or to imitate them.

5. Those who are almost or entirely dependent in their thinking.

Note: If a pupil has the originality to think out a project completely, but lacks perseverance or the practical ability to carry it out entirely, he should still receive credit for his originality, but his weakness should be shown under some other head (such as perseverance) or should be pointed out under "Remarks."

B. Reasoning, including the Ability to Grasp the Facts on which the Reasoning is Based.

Class 1. Those who are capable of a complete grasp of all sides of a subject, and of reasoning accurately about abstract as well as concrete matters.

2. Those who show a good grasp of facts and reason well about them unless the steps of the reasoning become quite complex or too deep, when they become confused.

3. Those who are somewhat uncertain in their reasoning, sometimes basing it on insufficient data. They reason much better concerning definitely concrete matters, and in that with which they are specially familiar.

4. Those who see only part of the facts, and find it difficult to see relationships between them, and to draw accurate conclusions.

5. Those who are very dull. They grasp only simple ideas, and are almost or wholly incapable of abstract reasoning.

C. Speed of Learning.

Class 1. Those who after once hearing or reading subject matter (the length and complexity depending on the age of the child) know accurately the facts stated.

2. Those who get a fair idea of content from once hearing or reading, but need a repetition to complete the understanding.

3. Those who approximate the success of Class 2 on shorter or less complex material, or who need still another repetition to fix the details of the content.

4. Those who learn only by considerable repetition and effort.

5. Those who are very slow, making little headway in the time used by an average child for the same purpose.

Note: There will often be a difference in the ease with which the child learns through the ear and through the eye. A note should be made under "Remarks" when the child is thought to be "Earminded" or "Eyeminded."

D. Retention.

Class 1. Those who remember in usable form practically all that has been learned.

2. Those whose memories are good. The difference between one of this group and one of Class 1 may lie in a less complete memory, or in remembering for a shorter time.

3. Those who have fair memories. They remember well where a strong interest appeals to them, but may lose even important matters if this motive is lacking. They bring back facts after being reminded by others, but seem to have less ability than the higher classes to draw at will from their store of knowledge.

4. Those whose memories are unreliable. They may remember facts incorrectly, or know what has been learned for a short period only, losing it nearly, if not quite, as soon as it serves an immediate purpose.

5. Those whose memories are very poor. They hold only simple facts, except with great effort.

In using this intelligence classification a teacher marks a pupil by a four-figure number, as 2234, which would indicate that the

child showed considerable originality when given slight help, was above the average in grasp of data and ability to reason about it, but was only normal in speed and did not retain well. Such a child would evidently merit study to find why with such good ability in reasoning and originating there should be subsequent loss of what had been learned.

It will be seen that while this method of marking intelligence does not require very fine distinctions on the teacher's part, it makes it possible to give a child any one of 625 intelligence ratings, and presents a four-sided view of his intelligence as it appears to the teacher.

Although supervisors and teachers generally are willing to concede the value of such attempts as these to study the pupils, there arises the very natural question as to the possibility of teachers finding time to do such intensive marking.

In the first place the complete marking is done but once a year, in December, when the teacher has had time to study the pupils, but it is still early enough to use the results of that study. Certain additions and corrections may be made later, but do not take much time.

The question then comes to this: "Is it worth while for a teacher to know her pupils well enough to judge with some accuracy their most important characteristics?" If it is, whatever time is spent in actually recording the results of her study of the pupils is a minor matter, and is undoubtedly justified by the aims given at the beginning of this paper. Even if less time is given by the teacher to lesson preparing and other routine obligations while this investigation is under way, the final result in better understood pupils will enable her to more than make up any loss of time before the end of the year.

After all, it is ridiculous to prescribe before we diagnose. If teachers cannot diagnose under present conditions, then those conditions must be changed. Some method of complete, reasonably scientific, child study is absolutely necessary, and the sooner we recognize this and perfect that neglected side of our school procedure, the better it will be for education and for our pupils.

THE PARK SCHOOL,
BALTIMORE, MD.

APPLIED MATHEMATICS IN HIGH SCHOOLS. SOME LESSONS FROM THE WAR.*

By William E. Breckenridge.

The war revealed to us America unprepared in mathematical training as in most other respects. A Colonel in Camp Upton reported as follows: "More men are required at Camp Taylor for the Field Artillery and no more can be found in this Camp who have the required mathematical training." What was this required training? The circular from Camp Taylor read: "Algebra through quadratics and Plane Geometry. The solution of triangles by Trigonometry is advised, but not required for entrance." As a matter of fact the essential algebra as revealed by the examinations set included hardly more than the use of formulas and ratio and proportion, while the goemetry was only mensuration. The original intention of the examiners for the Field Artillery School was to require all candidates to be graduates of high schools, but it was soon evident that this standard could not be maintained and an adequate supply of men secured. For the school at Fort Monroe, where men were trained for the Heavy or Coast Artillery, the requirement in mathematics was considerably more, including Plane Trigonometry.

When it became evident that there were not men enough in the country properly trained in mathematics for entrance to these artillery schools, the Government established a preparatory school near New York where a brief preliminary course could be taken before the examination for admission to the Heavy Artillery. At Camp Taylor, also, a preparatory course in mathematics was given consisting of very elementary practical mathematics before the men were considered properly fitted to undertake the real work of the Field Artillery.

In New York City Emergency Courses in Mathematics were given by the Y. M. C. A. and by Columbia University, designed to prepare men for the two schools of artillery in the shortest

* This paper was read at the Educational Congress in Albany, N. Y., in May.

possible time. It was found possible to do this work for most candidates in ten lessons of two hours each.

After the Armistice had been signed and plans were developed for reconstruction, one of the courses recommended for wounded soldiers was in The Use of the Slide Rule. A pamphlet was written under the direction of the Surgean-General's Office and the Board of Vocational Education giving ten lessons in very simple language such as could be understood by a soldier who had only had six grades of schooling. This work is now going on in the hospitals of the United States.

At Fort Monroe, under the able direction of Major Englehardt, an admirable system of instruction was developed. The daily program consisted of field work in the forenoon, lectures in the afternoon, and supervised study in the evening. Would not this arrangement delight the heart of any teacher of mathematics? The work of this school was very efficient. Yet when several French artillery officers inspected the school, one of them remarked, "You have a very fine kindergarten." Compared with the instruction in Frane, our work seemed very elementary.

Perhaps enough has been said to show that America was not prepared for war in the mathematical training of her young men. This is the first lesson in the teaching of mathematics to be learned from the war. It is one which those who are demanding less time for the teaching of mathematics would do well to ponder. In the new program for military training in our country it is evident that mathematics will have an important place.

A second lesson that the war has taught us is that much of our present subject matter in elementary mathematics is of no practical value and could profitably be replaced by material that is practical and at the same time has more value for cultural training. This material may be taken from arithmetic, algebra, geometry, and trigonometry. It includes real problems from everyday life for the purpose of motivation, illustration, and vocational training. It does not neglect thorough drill on fundamental operations necessary for the solution of these real problems. Teachers of mathematics know that the greater part of the time during the recitation must be spent in drill on the

mechanical operations until pupils acquire correct mathematical habits. This drill is not likely to be neglected. The emphasis at present should be in encouraging the use of practical problems. A real problem may be defined as a situation that happens to someone, somewhere, somtime. It is thus sharply distinguished from most of the problems in our algebras which never happen to anyone, anywhere, anytime. Of course, real problems should be selected that are within the experience of the particular pupils who are being instructed.

Following are some suggestions for improving our teaching of mathematics by the use of real applied problems:

1. The requirement in mathematics should be extensive enough to include a thorough working knowledge of practical mathematics. If mathematics is required through the ninth year, and is arranged so that the student may have an opportunity to take the essentials of algebra, geometry, and trigonometry, this can be accomplished. The new courses for Junior High Schools promise to help largely in this matter.

The early introduction of portions of physics into the curriculum, as is done at present in the first term of The Stuyvesant High School in New York City, opens a large field for practical problems.

2. The curriculum should be arranged so that the most useful mathematics may come first. It is evident that a controlling principle is necessary for the most effective course. The following is suggested: "What is the best mathematics for the pupil, no matter how long he remains in school?" Many pupils drop out during the first year of high school. What is the best mathematics that we can give them while they are with us? This seems to include the following topics, to be taught preferably by the Project Method: Real problems involving the use of the formula, how to make a formula, how to translate it into oral or written English, how to apply it to problems, how to solve it for any letter and interpret the results. Real problems involving the mensuration of all the common plane and solid geometrical figures.

Graphs of statistics, short methods, and checks will be included in this early work.

In an ordinary high school, ten weeks is sufficient for the

practical mathematics. If a longer course is desired, the slide rule and the practical part of trigonometry may be added. At the end of this course, the pupil will be equipped with sufficient mathematics to enable him to read mechanics' handbooks and elementary physics. If he must leave the day school he can attend science courses in an evening school. If he leaves at the end of ten weeks we have at least given him the mathematics that he needs most.

The second ten weeks may be used for equations of elementary algebra through quadratics. The test of whether a subject belongs in this part of the course is its use in solving an equation. The field of practical problems within the pupil's experience has been exhausted in the first ten weeks. In the second ten weeks, problems are concrete, but not many of them are real. This is the kind of applied problems found in the ordinary text-book in algebra. From this course will be omitted nearly all of factoring, fractions, radicals, and exponents.

Having finished a half year of work, the question is "Will it now be better for the student to finish the elementary algebra including the abstract work of factoring and fractions, or will it be better for him to have some of the splendid training in reasoning that comes in demonstrative plane geometry?" Most educators believe the latter plan is the better. It involves beginning plane geometry six months earlier than usual, but the subject matter may be made somewhat easier, if necessary, in the first course, by the omission of some theorems and the assumption of some others without proof. This plan has been tried in some of the largest schools in this country with successful results. The teaching of the subject six months earlier has not seemed to show any appreciable difference between the ability of these students and those on the former plan.

In the second year, first half, finish plane geometry.

In the second half, finish elementary algebra, including factoring, fractions, and radicals. Here again there will be some difficulty at first, because the pupils have not studied algebra for a year. At first it will seem like beginning algebra all over again. But the greater maturity of the pupils, and the fact that the poorer mathematical students have been eliminated by this time will soon show in the work of the class and render it very

easy to complete the elementary algebra within this half year. This arrangement of elementary mathematics does not retard the pupil who is going to college and it does give all students the mathematics that they need most in the order of its usefulness.

3. In all mathematics teaching practical problems should be used more largely for motivation and illustration. Where real problems are not available, concrete problems that are not real may be used. When a teacher begins to present a new subject, the approach should be by a problem involving that subject. For example, if it is desired to teach equations in x and y, present to the class at the beginning of the lesson a concrete problem whose solution involves an equation in x and y. As soon as the necessity for the new operation is evident, of course, most of the time of the recitation will be used in drill upon the mechanical operations involved until correct mathematical habits are developed. Most of our text-books could be improved in this respect. However, it is always possible for the teacher to supply the motivating problem, whatever the text-book.

For illustrative purposes we now have a large number of real problems in the fields of carpentry, housebuilding, metal-working, forestry, land measurements, physics, and mechanics. A new field has recently been opened involving Thrift, Savings, and Investment. Considerable literature has already appeared in this field. Evidently much of the Thrift of war time is to be continued in time of peace. Monographs on Thrift may be obtained from the Board of Vocational Education, Washington, D. C.

Teachers are usually ready and willing to use real problems if they are available. It is suggested that a card catalogue be developed classifying these real problems under their mathematical subjects and referring to the text where these problems may be found. In connection with a good library of reference books this catalogue will enable a teacher to find very quickly a real problem for motivating or illustrating the subject of the day's lesson.

4. Vocational courses in The Slide Rule, and the use of Surveying Instruments should be more largely organized. The Battery Commander's Ruler and The Musketry Ruler are instruments that can be utilized in the mathematics class room.

5. A method of teaching emphasized by the war was The Coöperative Plan under which the student works one week in school and the next in a shop, alternating throughout the course. Various modifications of this plan are in use for courses in Applied Mathematics. It works particularly well in surveying.

6. The Colleges and The College Entrance Examination Board should make courses in applied mathematics count definitely toward College Entrance.

7. In teaching Trigonometry, the practical part should be taught first with as much field work in surveying as can be arranged. The formulas may be assumed. Follow this with The Slide Rule, then complete the course by teaching the proofs of formulas, identities, and the solution of trigonometric equations.

8. In conclusion, while the greater part of our time as mathematics teachers will quite properly be spent upon the development of correct mathematical habits in our students, by means of drill on the mechanical operations, "problems without content," yet much can be done to improve the efficiency of our mathematics teaching by (1) the rearrangement of the curriculum with the controlling thought "What is the best mathematics for the student, no matter how long he remains in school?"—which means teaching the real applied problem first. (2) The increased use of practical problems for motivation, illustration and vocational training.

Let us not allow our zeal for practical problems to lead us to a neglect of the necessary parts of pure mathematics. There should emerge from any good mathematical course students who are well equipped with correct habits in mathematical calculation. But these habits do not need to be dissociated from application. Rather it is an advantage even on the side of training, to have mathematical laws associated with real problems.

In the struggle to make the world safe for democracy, what is more inspiring to a teacher of mathematics than to feel that he is not only keeping the standard high for the ten per cent. who go to college and become leaders, but he also has a part in making mathematics democratic, *i.e.*, of the most use to the most people?

TEACHERS COLLEGE,
NEW YORK CITY.

A JUNIOR HIGH SCHOOL COURSE IN MATHEMATICS.*

BY EMILY RENSHAW.

In attempting to formulate any course, or program of study, two dominant thoughts must guide, direct and mould its formation. First the definite aims, the definite object of the proposed course; and second, the selection and arrangement of such subject matter as will, at least, approximately realize those aims and ideals.

In planning a curriculum in mathematics for the junior high school, not only the above features were considered, but also the adjusting any course decided upon to the mathematical requirements of the senior high schools, so the pupils entering those schools from the junior high school need not be handicapped mathematically. To construct a program of study that would satisfy all requirements of both senior high schools was found to be impossible as each school emphasizes a different mathematical phase in the freshman year. And, may I suggest here parenthetically, if, in the near future, some steps could be taken for a closer coördination of interests of the various departments of the different high schools, without impairing the efficiency or ideals of any school, it might result in the arrangement of a course that would remove those differences that now tend to embarrass pupils transferred from one school to another.

It was further found necessary, in justice to pupils admitted to the junior high school and transferred to elementary schools, to incorporate into the course much of the material found in the seventh and eighth grade courses in mathematics.

What are the mathematical aspirations of the junior high school; what are the aims, the object, the ideals toward which it aspires?

The school consists of the seventh, eighth, and ninth grades,

* An address delivered before the High School Mathematics Teachers of Philadelphia, April, 1919.

the pupils of which range in age from twelve to sixteen years and over. That means that the junior high school receives them at that critical, but interesting age of adolescence; the age of extreme self-consciousness; the age of excessive sensitiveness; the age when reason is demanding things in terms of life; the "whys" are demanded for statements that formerly were accepted indifferently. It is the age that insists that school activities be linked up with life, and any course that fails to take cognizance of these characteristics and adheres to the bare formalism of subjects fails irrevocably and cannot justify its existence.

So the aims and interpretations of the course are to show the boys and girls that mathematics is not an exclusive subject reserved for the favored few, but one that is mightily broad and is vitally necessary to success in the struggle for existence. The plumber, the carpenter, the painter, the builder, the salesman, the engineer, the business man, the clerk, the bookkeeper, the cook, the dressmaker, the homemaker, must have clear mathematical ideas to be successful and efficient.

While in no way discounting the efforts that tend to develop the pleasure and satisfaction that undoubtedly follow the solution of complicated problems, and while in no way ignoring the disciplinary and cultural advantage of mathematics, the junior high school undoubtedly emphasizes its utilitarian value, and while so doing attempts to develop clear reasoning, concise statements and accuracy of expression.

In the seventh A, the fundamental operations are reviewed for accuracy, speed and number combination; fractions are taken and applied in the most practical way; decimals are reviewed. Percentage and its various applications, profit and loss, commission, trade discount, taxes, interest, open a wide field for problems that link up with life.

In the seventh B, involution is introduced, preliminary to the teaching of square root. The measurements most commonly used, inches, square inches; feet, square feet; yards, square yards; miles and acres are subsequently employed in the mensuration that follows. This includes the dimensions and area of the geometric figures, square, rectangle, triangle and circle. Problems correlating this work with everyday activities; such

as, papering, plastering, carpeting, painting, paving, as well as with the work of the department of arts and shop are constantly presented for solution. The mere formal solution is not accepted in the performing of any of the above problems unless accomplished by some expression of the mode of procedure applicable in each case.

The eighth A continues the development of the geometric sense by introducing cubic measure and its practical application. In each stage of the work, geometric construction goes hand in hand with the development of each new geometric idea.

The latter half of the eighth A is again devoted to arithmetic. The purpose being to give a brief review of business arithmetic, laying special stress on business forms; such as, bills, statements, receipts, checks, pass books, deposit slips. The various kinds of promissory notes are also reviewed and the effect of the different kinds of endorsements is taught in the most practical way. Later the many ways of saving money are discussed, and finally the pupil is made acquainted with the cash, personal and property, account. Pupils are encouraged to keep their own cash accounts no matter how small, and present them at stated times to their teachers for criticism.

This is the most popular part of our course in arithmetic. Why? Because it is perfectly obvious to the pupil that the thing he is studying is of vital importance to the business world—the world of work, with which he is most familiar, and into which he pictures himself as eventually becoming a part.

As algebra is introduced in the eighth B, the first month or more is devoted to presenting such type of work as will awaken the algebraic sense, and develop the algebraic method of thinking. To bridge this transition stage, simple formulas with numerical substitution as applied to business and mensuration are employed. A carefully selected type of problem connecting arithmetic and geometry with algebra is extensively used in this preliminary work. Checking is emphasized. Later the fundamental operations of algebra are taught ending in this grade with special products.

The ninth grade, or freshman year of the senior high school, introduces factoring, fractions, fractional equations and graphs. In the latter half of this year, or ninth B, simultaneous equa-

tions, graphs, square root, radicals, surds and quadratic equations are the requirements.

In passing from one grade to another in the junior high school, promotions are made by subjects, and the arrangement of the roster is such as to group children in classes according to ability. This plan permits the presentation of minimum essentials in mathematics to those pupils below grade, while the minimum essential plus the additional requirements are given to the normal pupil and those above grade.

Have the aims embodied in this course been realized? No; all that was aimed for, all that was hoped for has not been accomplished, and that for several reasons. One is the time element. While some junior high schools not only advocate but embody in the arrangement of their roster three mathematics periods a week, the Philadelphia Junior High School provides for four periods of forty minutes each. This is a shorter period than that devoted to the same subject either in the elementary or higher schools. Again, the junior high school has not had the opportunity to work out the full effect of any course on any one set of pupils. Next June a year, the first class that really has received the entire benefit of the junior high program of study will enter the senior high schools.

It is really too soon to judge definitely or finally as to the efficacy of any junior high aims as portrayed in its curriculum. The school itself is a wonderful experiment. We are still applying tests, but hope, in the near future, to show that the junior high school—its ideals and their realization—is one of the most important adjuncts to the educational system of Philadelphia.

Our program of study is not permanent; at any time that which proves itself inadequate or non-essential will be readily replaced by that which is helpful and necessary. The ninth grade portion of our outline of study presents many features that were reluctantly recognized and accepted. The algebraic content of this part of the course is too great to secure clearness of thought and facility and accuracy of operation. Time will not permit the drill necessary to obtain these results. Yet the ground must be covered in order that our boys entering the senior high school be not at a disadvantage; and in emphasizing these algebraic requirements for the boys, the girls are forced

later in the senior high school to make up work not accomplished in the freshman year. We know the course is not perfect.

As a large percentage of our pupils select the commercial course in continuing their studies in the senior school, it is a debatable question whether so much time should be devoted to that aspect of mathematics that will not be of material advantage in the future. "Then why not have elective courses in the junior high?" you ask. That is also a question worthy of discussion, but for the present, it is thought that the province of the junior high is to give the pupil a general survey of all courses—academic, commercial, domestic, and then let him or her specialize in the senior school. If this is the true interpretation, then the ninth grade program of study is not ideal, and its inconsistencies and wrongly directed energies can only be rectified by the getting together of all interested in this problem and working out a plan that embodies those features which will harmonize the educational aspirations and aims of the schools into whose care these children are committed.

So we are not irrevocably committed to any set course. Any time we are willing to rearrange in part or entirety if, by so doing, we administer to the welfare of the pupil.

But in spite of any shortcomings the course may reveal on close analysis, this we feel we are accomplishing: The pupil who formerly thought mathematics beyond his ken, a subject into whose realm only few entered, has discovered that it really has something for him, that is, really does bear on life's interests, and so he is approaching his mathematics room perhaps reluctantly, but half willing to be led; the mediocre pupil has seen much that so arouses his interest that occasionally he passes from the class of mediocrity into the class bright; that fortunate pupil who some day may become an adept in mathematics insight, discovery and solution has ample food to feed his genius.

As a class passes into a room, the mathematics teacher is confronted with two big interests—the subject and the pupil, but the greater of these is the pupil.

Holmes Junior High School,
Philadelphia, Pa.

A SIMPLE METHOD OF CONSTRUCTING A HYPERBOLIC PARABOLOID.

By E. J. Cuy [Couyumdjopoulos].

The famous "saddle-shaped surface," $z = ax^2 - by^2$, so useful in demonstrating the peculiarities of fairly complex surfaces, —such, for example, as the fact that a surface may give a curve with a maximum (a parabola) as its intersection with one of the coördinate planes, a curve with a minimum with another and two straight lines with the third,—is not a very easy surface to construct.

The following is a simple method of constructing it:—

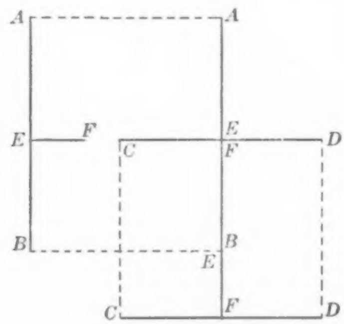


Fig. 1.

Two equal pieces of straight stiff wire (or glass rod), *AB* and *CD*, are soldered to a third piece *EF* perpendicular to it and perpendicular to each other, as shown in figures 1 and 2. Then starting at *E*, *EA* and *EB* are divided into an equal number of equal parts. *CF* and *FD* are divided similarly.

Then by means of thread join point 1 of *AE* to point 1 of *CF*, point 2 of *AE* to 2 of *CF*, etc. A shellac coating on *AB* and *CB* before and after winding the thread will keep it in position.

If *AB* is now rotated about *EF* through an angle of 45° and the midpoint *G* of *EF* is chosen as the origin, *EF* will be the

x-axis of the hyperbolic paraboloid, and a vertical and a horizontal line both perpendicular to EF at G will be the z- and the y-axes respectively.

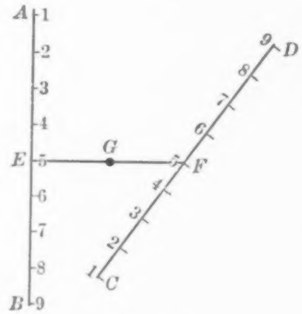


FIG. 2.

If either E or F is used as the origin and EF as the z-axis, the equation of the surface will be

$$xz = (c - z)y, \quad \text{or} \quad (x + y)z = cy.$$

CLARK UNIVERSITY,
WORCESTER, MASS.

THE NATIONAL COMMITTEE ON MATHEMATICAL REQUIREMENTS.

The National Committee on Mathematical Requirements was organized in the late summer of 1916 for the purpose of giving national expression to the movement for reform in the teaching of mathematics which had gained considerable headway in various parts of the country.

The membership of the Committee at present is as follows:

Representing the colleges: A. R. Crathorne, University of Illinois; C. N. Moore, University of Cincinnati; E. H. Moore, University of Chicago; D. E. Smith, Columbia University; H. W. Tyler, Massachusetts Institute of Technology; J. W. Young, Dartmouth College (chairman).

Representing the secondary schools: Vevia Blair, Horace Mann School, New York (representing the Association of Teachers of Mathematics in the Middle States and Maryland); W. F. Downey, English High School, Boston (representing the Association of Teachers of Mathematics in New England); J. A. Foberg, Crane Technical High School, Chicago (vice-chairman) (representing the Central Association of Science and Mathematics Teachers); A. C. Olney, Commissioner of Secondary Education, Sacramento, California; Raleigh Schorling, The Lincoln School, New York; P. H. Underwood, Ball High School, Galveston, Texas; Eula Weeks, Cleveland High School, St. Louis, Mo.

Last May, the committee was fortunate in securing an appropriation of $16,000 from the General Education Board, which has made it possible greatly to extend its work. This work is being planned on a large scale for the purpose of organizing a nation-wide discussion of the problems of reorganizing the courses in mathematics in secondary schools and colleges and of improving the teaching of mathematics.

J. W. Young and J. A. Foberg have been selected by the committee to devote their whole time to this work during the coming year. To this end they have been granted leaves of absence by their respective institutions.

The following work is being undertaken immediately.

1. To make a careful study of all that has been said and done, here and abroad, in the way of improving the teaching of mathematics during recent years.

2. To prepare a bibliography of recent literature on the subject.

3. To make a collection of recent text-books on secondary school and elementary college mathematics.

4. To prepare reports on various phases of the problem of reform. Eleven such reports are already under way and others are being projected.

5. To establish contact with existing organizations of teachers with the purpose of organizing a nation-wide study and discussion of the committee's problem. The committee hopes to induce such organizations to adopt this problem as their program for the year. It is ready to furnish material for programs and also to furnish speakers at meetings. The organizations in their turn are to furnish the committee with the results of their discussions and any action taken. In this way it is hoped that the committee can act as a clearing house for ideas and projects and can be of assistance in coördinating possible divergent views entertained by different organizations.

6. To promote the formation of new organizations of teachers where such organizations are needed and do not exist at the present time. These organizations may be sectional, covering a considerable area, or they may consist merely of local clubs which can meet at frequent intervals for the discussion and study of the problems of the committee. It is hoped that such clubs can be organized in all the larger cities where they do not already exist.

7. To establish contact directly with individual teachers. The committee feels that this is necessary in addition to their work through organizations in order to induce such individuals to become active and in order to make the work through organizations effective. Plans for establishing this contact with individuals on a large scale are under consideration, possibly through the publication of a bulletin. These plans, however, are as yet in a tentative stage.

Organizations can be of assistance by sending to the com-

mittee a statement of the name of the organization, its officers for the coming year, the time and place of its meetings and information regarding proposed programs. If any organization has within the last ten years issued any reports on topics connected with the work of the committee, copies of such reports should, if available, be sent both to Mr. Young and Mr. Foberg. If this is impossible, a statement regarding the character and place of publication of any such reports would be welcome.

Individuals can be of assistance—(1) by keeping the committee informed of matters of interest that come to their notice; (2) by suggesting ways in which the committee can be helpful; (3) by sending to the committee in duplicate reprints of any articles they publish on subjects connected with the committee's work; (4) by furthering the work of the committee among their colleagues, organizing discussions, etc.

It is not too much to say that the existence of this committee with its present resources gives the teachers of mathematics, both individually and through their organizations, a unique opportunity to do really constructive work of the highest importance in the direction of reform. They can surely be counted on to make the most of this opportunity.

EDITORIAL.

Dr. William H. Metzler has returned from France, where he has been engaged in educational work, and he will resume his editorship of THE MATHEMATICS TEACHER with the December issue.

It seems a fitting time to call the attention of the readers of this magazine to the debt they owe to Dr. Metzler. The magazine was started largely by his initiative, and he has carried it on ever since. The actual money value of the time he has given freely would be many thousands of dollars, and his devotion to the work could not be repaid by any amount.

When it is considered that this magazine is furnished to members of the association for fifty cents a year, despite its necessarily limited circulation, something of the magnitude of the task facing the editor can be appreciated, but only those who have been associated with Dr. Metzler in the actual work can realize its difficulties.

It seems that the least those of us who profit by the magazine can do is to relieve the editor of unnecessary labors. One of these is the constant following up of all available material for publication and for advertising. If the authors of papers read at various meetings, such as the general association and the sections, would give their copy to the secretaries promptly, and if the secretaries in their turn would see that such papers were turned in to them, and would mail them at once to the editor, much worry and work would be saved.

If all of us would volunteer articles when we had something worth publishing, and would suggest possible advertisers with whom we might have some personal influence, that too would save much time. What is an unreasonable burden for one man to carry, will be much less if distributed somewhat among many of us.

Let's show Dr. Metzler our appreciation by better team work in the future.

E. R. S.

BOOK REVIEWS.

Div-A-Let (Division by Letters). By W. H. VAIL. The Revell Company Press. Pp. 70.

For anyone who is interested in arithmetical puzzles this book will be a source of great pleasure. The numbers in various long division examples are replaced by letters, each letter keeping the place of the same number throughout the division, and the solver is required to find the word spelled by the letters when they are placed in their correct numerical order. The rules of long division give ample information concerning the relations of the letters and the numbers they represent, but the picking out of suitable facts and finally solving the puzzle is by no means without difficulty.

Correlated Mathematics for Junior Colleges. By ERNST R. BRESLICH. Chicago: The University Press. Pp. 301. Price $1.25.

This book is a continuation of the series worked out by Mr. Breslich for the usual high school course. It is suited to the first year of college, though it may be used in the senior year of high school. In it are combined college algebra, plane analytics, and some differential calculus.

The book is consistent with the methods in the earlier books of the series, and the work seems even more closely related on account of the character of the subjects. The text is particularly attractive in its makeup, and the subject matter is sound, well arranged, and clear.

THE Committee on Special War Activities of the National Catholic War Council is publishing a series of Reconstruction Pamphlets. Numbers 5 and 6 are, respectively, "A Program for Citizenship" and "The Fundamentals of Citizenship."

Both of these books are valuable contributions for native- as well as foreign-born Americans. They are free of religious propaganda, and give concise clear outlines of the important fundamentals of our citizenship and government.

The committee should be congratulated on such a constructive work.

New High School Arithmetic. By WEBSTER WELLS and WALTER W. HART. New York: D. C. Heath and Co. Pp. viii + 358.

This book furnishes a good compromise between a course in "Business Arithmetic" and one that follows more nearly the procedure of the grammar school. It has a good review of the fundamental operations and their common use, an introduction to geometry through its numerical applications, and a good treatment of the common business forms and

methods. The book is carefully written, and contains many excellent features.

Solid Geometry, Revised Edition. By H. E. SLAUGHT and N. J. LENNES. New York: Allyn and Bacon. Pp. vi + 211.

In this book the authors have carried out again the features that distinguish their former books on geometry. There is an increasing tendency to leave some scope for the pupils' originality in the propositions, and a good amount of exercises are included. Excellent features are the summaries at the end of each book, and the table of the axioms and theorems from plane geometry that are used in the text.

Elementary Mathematical Analysis, Revised Edition. By CHARLES S. SLICHTER. New York: McGraw-Hill Book Company. Pp. xviii + 497. Price $2.50 net.

The author has written a very well developed and interesting text. While the general plan followed in the earlier edition is still kept, the book shows many improvements.

The review of elementary algebra in the appendix is an admirably condensed résumé of its important topics. The body of the text is well written, being clear and yet wasting few words. There are so many clear-sighted features that it is surprising to find this author, like so many others, making two cases for the proof of the "Law of Sines."

On the whole, the book seems unusually well worth examination.

College Algebra, Revised Edition. By H. L. RIETZ and A. R. CRATHORNE. New York: Henry Holt and Company. Pp. xiii + 268.

This revision keeps the general character of the original book, but is somewhat simplified and includes many new exercises.

Its best feature seems to be the way the broader viewpoint suitable to the college student is evolved in the review of high-school algebra.

The topics are well chosen and well developed.

New Modern Illustrative Bookkeeping, Introductory Course. By CHARLES F. RITTENHOUSE. New York: American Book Co. Pp. 152. Price $1.20.

This is a very practical and well worked out text on bookkeeping. The facsimile reproductions of business papers are excellent, as are the varying price lists.

The introduction uses the account method.

Essentials of Arithmetic. By SAMUEL HAMILTON. New York: The American Book Company. First Book, pp. 370. Second Book, pp. 435.

The "First Book" covers the ground usually taught in the second through the fifth years; the "Second Book" completes the subject through the elementary school.

The work through the sixth year is planned to give the pupil skill in the ordinary operations and in applying them in the more common situations. The material for the last two years covers a wide field of applications of a more advanced and less universally used kind. The books seem to be well organized and worthy of careful consideration.

Complete School Algebra, Revised Edition. By HERBERT E. HAWKES, WILLIAM A. LUBY, and FRANK C. TOUTON. Boston: Ginn and Co. Pp. ix + 507. Price $1.40.

This revision follows the same lines as that of the authors' "First Course in Algebra," and "Second Course in Algebra," which have already been reviewed. There has been considerable elimination of unnecessary material, but the review material has been expanded to allow of wide choice.

An excellent feature is the emphasis given to oral exercises.

Higher Arithmetic. By GEORGE WENTWORTH and DAVID EUGENE SMITH. Boston: Ginn and Company. Pp. v + 250. Price $1.00.

This book is intended for normal schools and high schools. It seems a sensible, well arranged course, omitting some of the little-used chapters formerly included under such a title, but adding logarithms, the use of the slide rule, and tables of roots.

The Winston Simplified Dictionary. Edited by WILLIAM DODGE LEWIS and EDGAR A. SINGER. Philadelphia: John C. Winston Co. Pp. 820. Price $.96, postpaid.

This dictionary lists over forty thousand words, each set out in bold type to catch the untrained eye, and each defined in terms easy to understand. It contains six full-page color plates, and eight hundred text illustrations. Such a book should not only be an aid to the pupils and teachers in the elementary and high schools of the country, but should also be of particular value in vocational and continuation schools, and in Americanization classes, where older men and women are endeavoring to get a command of the language to fit them for intelligent citizenship.

The Merrymakers in New York. By HERSCHEL WILLIAMS. Boston: The Page Company. Pp. 321.

This story tells of the visit of four children to their older brother who is a reporter in New York. It is interesting, and, without preaching, leaves many lessons of service and high ideals.

NOTES AND NEWS.

DR. WILLIAM H. METZLER, editor-in-chief of THE MATHEMATICS TEACHER since it was started, has returned to Syracuse University ofter completing the work for which he was sent to France. It is a great pleasure to welcome him home.

* * * *

IN order to avoid duplication of labor, the bills for dues as well as subscriptions will in the future be sent out from the office of the editor.

* * * *

THE New York Institute for Public Service has issued a letter protesting against the use of median salaries in the N. E. A. bulletin, "Higher Salaries for Teachers." The reason is that medians do not show the possibilities of the positions, and therefore tend to discourage applicants.

* * * *

THE United States Treasury Department is waging an energetic campaign urging all men who have been in service to keep up their war risk insurance. Very liberal conversion privileges have been added.

* * * *

A STRONG movement to bring about the exclusive use of the metric system is under way both in England and in the United States. A typical statement in regard to it follows:

Hon. William C. Redfield, Secretary of Commerce of the United States government, has declared himself in favor of the adoption of the metric system of weights and measures by the United States. His study of world conditions, as a manufacturer and as a government official, has led him to this conclusion.

Secretary Redfield declares that to obtain world trade or to hold that which we have, we must adopt metric standards, because our customers demand it. It is easy to make the change,

he says, and once adopted, the metric system, because of its simplicity, would prove invaluable.

"I think you will find that the view I have expressed is daily more representative of those who control the resources and credit of U. S. America," declares Secretary Redfield. "I would not cause needless expense to any American concern nor advocate that even necessary changes be made too suddenly, but I would point out to them that we can not think in 1919 the thoughts of 1914 (to our safety and advantage), because we are living in a different world. One of the problems involved in our adjustment to the new world is this matter of simplified weights and measures, and we may as well prepare at once gradually to make the changes necessary."

* * * *

Roosevelt Memorial Association.

The Roosevelt Memorial Association has been formed to provide memorials in accordance with the plans of the National Committee, which will include the erection of a suitable and adequate monumental memorial in Washington; and acquiring, development and maintenance of a park in the town of Oyster Bay which may ultimately, perhaps, include Sagamore Hill, to be preserved like Mount Vernon and Mr. Lincoln's home at Springfield.

In order to carry this program to success, the Association will need a minimum of $10,000,000, and so that participation in the creation of this memorial fund may be general, it asks for subscriptions thereto from millions of individuals.

Colonel Roosevelt was the greatest American of his generation. He blazed the trail which this nation must travel. Unselfish and sincere in purpose, unswerving in seeking the right and following it, definite and direct in action, with his theory of personal responsibility for wrong-doing and his creed of "the square deal" for all, he gave a lifetime of devoted public service which must stand as an inspiration to the youth of this land for all time. Ardently American, believing profoundly that only through fullest acceptance of America's privileges and responsibilities could the people of this country realize their highest well-being and fulfill their obligations to themselves and to humanity,

he set up ideals which it is not only a duty but a privilege to follow.

A memorial to this man will not so much honor him as honor America and the citizens who raise it to him. A contribution to the Roosevelt Memorial will be, in the highest sense, a pledge of devotion to ideal citizenship. Checks may be sent to Albert H. Wiggin, Treasurer, Roosevelt Memorial Association, 1 Madison Avenue, New York City.

WILLIAM BOYCE THOMPSON,
President, Roosevelt Memorial Association.
1 MADISON AVENUE, NEW YORK CITY.

* * * *

NEW YORK, August 17, 1919.

The following is authorized by the General Education Board:

The General Education Board has appropriated $16,000 for the use of the National Committee on Mathematical Requirements, appointed by the National Mathematical Association of America, for the purpose of undertaking a study looking to improvements in the mathematical curriculum of the secondary schools of the country.

Mathematicians, as well as educators in general, have in recent years criticized the prevailing high-school work in mathematics on the ground that much of the material is of little practical value, and on the further ground that the high-school curriculum in mathematics takes too little account of modern developments in this science.

The American Mathematical Association is made up of the leading professors and teachers of mathematics in American colleges and universities. It has appointed to conduct the inquiry, a committee composed of four university professors of mathematics and four secondary-school teachers of mathematics. Having no funds this body applied to the General Education Board for assistance. The board itself will not take any part in the study nor make recommendations.

The college and university men on the committee are Professor Crathorne, University of Illinois; Professor Moore, University of Cincinnati; Professor Moore, University of Chicago; Professor Smith, Columbia University; Professor Tyler, Mas-

sachusetts Institute of Technology, and Professor Young, of Dartmouth College. The secondary-school representatives are Miss Blair, Horace Mann School, New York; Professor Evans, Charleston High School, Boston; Professors Foberg and Crane, Technical High School, Chicago; and Professor Schorling, The Lincoln School, New York.

Professors Young and Foberg will devote their entire time to the work for a year or more.

* * * *

New Members.

Eugene Anders, 3300 North 15th Street, Philadephia, Pa.
Alice Fussell, 24 East Jefferson Street, Media, Pa.
Helen M. Short, 1511 Park Road, N. W., Washington, D. C.
Fanny F. Baker, Roland Park Country Club, Baltimore, Md.
Agnes L. Rogers, Goucher College, Baltimore, Md.
Howard S. Eitzel, 4552 Baltimore Avenue, Philadelphia, Pa.